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CITY COUNTY STATE

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THE USE OF MACADAM AS A BASE FOR BITUMINOUS TOP WILL BE DISCUSSED IN THE NEXT ISSUE.

IN THIS ISSUE

Snow Removal Tests
Excavating Small Earth Trenches
Resurfacing Concrete Roads
Selecting a Type of Road Surface
Two Illinois Asphaltic Pavements
Record Output of Central Concrete Mixing Plant

NOVEMBER 6, 1920

PUBLIC WORKS

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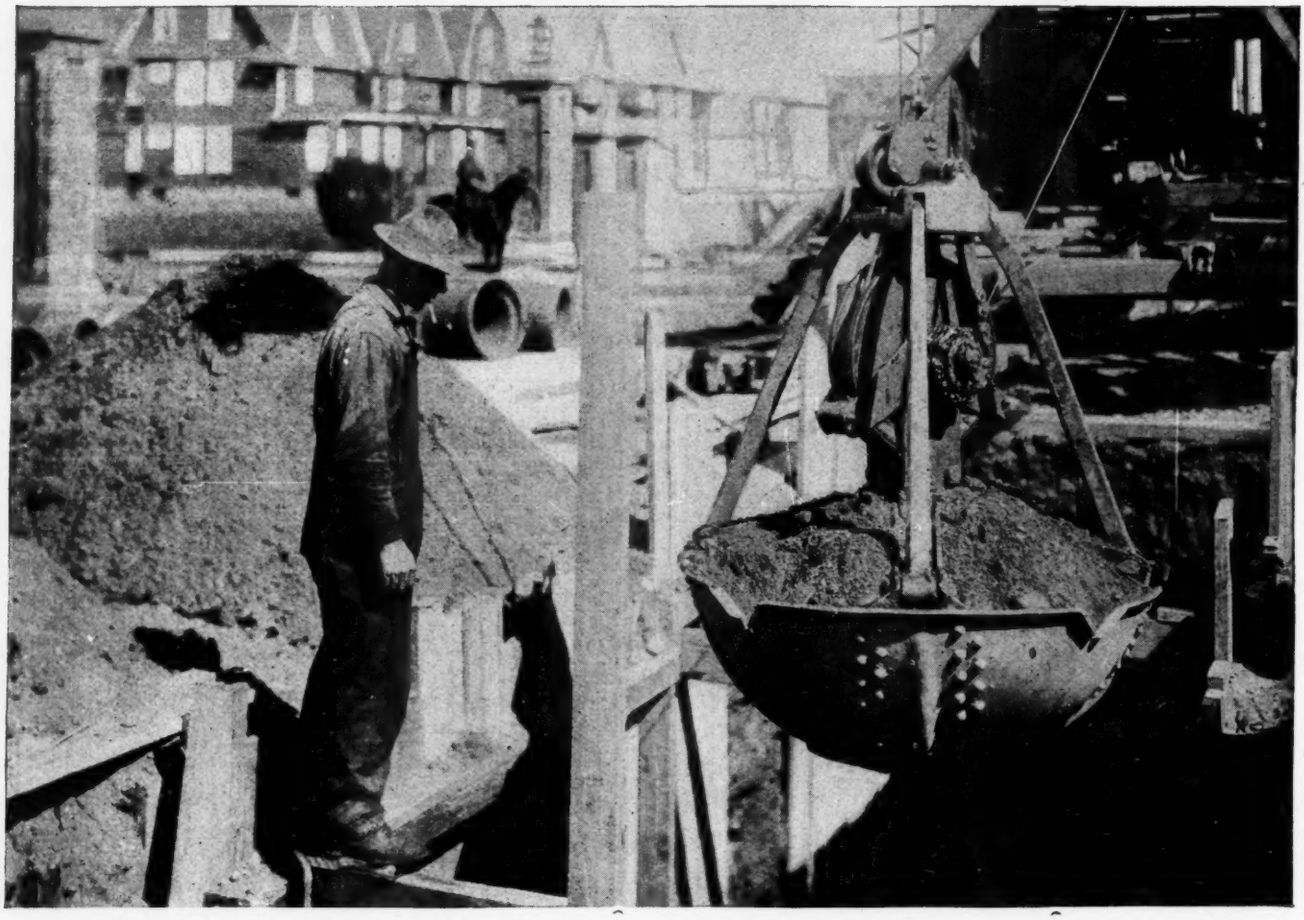

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PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, NOVEMBER 6, 1920 No. 19

Snow Removal Tests

Removal of snow from city streets is becoming increasingly common and expensive, and the larger cities are finding it a serious problem. The New York Street Cleaning Department, after experimental tests, has ordered 100 tractors and many motor trucks and has invited bids for other tractors, plows and other heavy equipment for next winter's service.

It is estimated that during the month of February, 1920, traffic tie-ups due to unexpected snow-falls cost the merchants of New York City $60,000,000 and the city itself $5,500,000 for emergency snow-removal work. Although the Department of Street Cleaning made strenuous efforts its equipment was inadequate to handle the situation and outside contractors were called in but failed at the critical time.

Horse-drawn snow plows and motor trucks were inefficient in the deep drifts. None of the equipment owned by the department, or available outside, was able to handle the heavy fall of packed snow, except a few small tank-type tractors which had been voluntarily offered for the work.

A snow-removal committee was appointed to report to the mayor on ways and means of handling the snow in the most efficient manner. The chairman, Fire Chief Kenlon, in view of successful fire-fighting experience, decided that it is imperative to have motor equipment which can be kept at work throughout the storms so that it will be necessary to clean up but a small part of the snow when the storm is over.

The Snow-Removal Committee, working on this basis, organized a series of tests that were made last July. All manufacturers of track-laying (caterpillar tractor) tractors were requested to compete in this event.

The tractors taking part in the demonstration were Holt, J. T., Monarch, Bates and Cleveland; all excepting the Bates being of the crawler or track-laying type. The Bates is equipped with crawlers in the rear, with the addition of two wheels in front to guide and for flexibility of operation.

TRACTOR HAULING SNOW PLOW IN REAR

The tests were made on Avenue C, between 18th and 19th streets, on July 29, 1920. Damp sand weighing 90 pounds per cubic foot was spread on the asphalt pavement over an area of 7,500 square feet (125 feet long by 60 feet wide), one-half to a depth of 4 inches and one-half to a depth of 6 inches

The Department of Street Cleaning snow plows with varying lengths of blades set at an angle of 45 degrees, were attached to tractors, which started at the edge of the sand bed and worked into a full width stroke, pushing the plow for the full length of the spreadings.

Equipped as before except with plow set at right angles, the tractors started in at the center of the 6-inch bed of sand in which the three heavy tractors (Holt, J. T. and Monarch) were required to push a full stroke for the entire length of the bed.

Finally, with the front plow raised out of the way and a Climax plow attached to rear end, the two smaller tractors (Bates and Cleveland) were to start at edge of the sand bed and, working into full stroke, plow windrows for the full length of the spreading. All the tractors fulfilled the requirements of the test.

RESULTING SPECIFICATIONS

Based on the results of these tests, specifications were prepared and bids invited by the engineer-

ing Bureau of the department for 150 gasoline motor-driven track-laying tractors. Each bidder was required to submit evidence that there are at least 50 of his make of tractors in operation in the United States which have each given not less than one year of service. The engine must be a four-cylinder, four-cycle engine, which will develop not less than 20 brake horse-power at governed speed.

Ignition must be by high-tension magneto with impulse coupling and motor shall be easily started by hand. In lieu of the high-tension magneto, dual ignition with battery and generator may be used. The engine shall be provided with a centrifugal governor which can be set to keep the motor at constant speed. Final drive must be gear, worm or chain.

A committee appointed to purchase snow-removal equipment decided to buy 100 small tank-type tractors, 50 large crawler-type tractors and a big fleet of trucks with dump bodies, together with the necessary push plows for the tractors.

The order for 100 small tank-type tractors has been awarded to the Cleveland Tractor Company, of Cleveland, Ohio, which will supply standard 12-20 Cletracs weighing 3,800 pounds each and equipped with winter tracks, a covered cab, a two-man seat, storm curtains and sirens.

Bids have been received for 50 heavy tractors weighing not less than 8,000 pounds each that must be manufactured by makers established at least eight years and builders of their own engines. Bids have also been received for three wrecking cars equipped with cranes, but contracts for them have not yet been awarded.

For use with the tractors there have been purchased 212 White 5-ton 6-yard automobile trucks with dump bodies, 75 of which are to be equipped with alternate 1,200-gallon flushing tanks for summer use; 100 2-ton Mack auto-trucks; 150 4-wheel and 300 auto-front plows made by the Good Roads Machinery Co.; 4 ¾-ton delivery trucks; and 1 Friedman's mechanical snow loader.

The tractor tests were conducted under the direction of Honorable Frank E. Eschmann, acting commissioner of street cleaning; A. A. Taylor, general superintendent; John Sondon, superintendent of snow removal; and Elmer Clark Goodwin, examining engineer, Department of Street Cleaning.

ENGINEER'S REPORT

A few weeks ago Mr. Goodwin submitted to Grover A. Whalen, commissioner of the Department of Plant and Structures, "full particulars of the purchase of trucks, tractors, plows and other equipment which the city contemplated making, as well as of the plan for co-operation between the street cleaning, fire, police and other city departments; likewise the plans for obtaining labor and hiring privately owned vehicles, with the employment of the contractor's and railroad's forces for the speedy removal of snow from the city's streets during the coming and subsequent winters." His report is as follows:

Organization—The organization for snow work will be divided into three classes:

1. Snow fighting to be composed of the department force and equipment augmented by hired laborers.
2. The contractor's forces for the removal of snow after the storm ceases falling.
3. The railroad's forces, which are the forces under the direction of the railroad companies assigned to the streets which they are obliged to clear of snow under the terms of their contract with the city and their respective franchises.

The general plan for the purchase of the various articles of equipment was set forth in the Snow Committee Report, of which Chief Kenlon was the chairman, and in accordance with such policy we have already awarded a contract for 212 five-ton gasoline trucks to the lowest bidder, the White Company. The specifications of the contract call for the delivery of the first fifty trucks about the first week in December and the balance of 162 trucks to be delivered by January 15, or in an installment of 50 trucks every 20 days after the first delivery.

Plans and specifications have been drawn for the purchase by public letting of:

100 two-ton auto-trucks.
150 four-wheeled plows.
300 auto-front plows.
150 tractors of the caterpillar type (100 known as the small size, not less than 3,800 lbs., and 50 not less than 8,000 lbs.).
3 wrecking cars equipped with cranes.
4 three-quarter-ton delivery trucks (for delivering supplies.)
1 mechanical snow loader (Friedman machine).

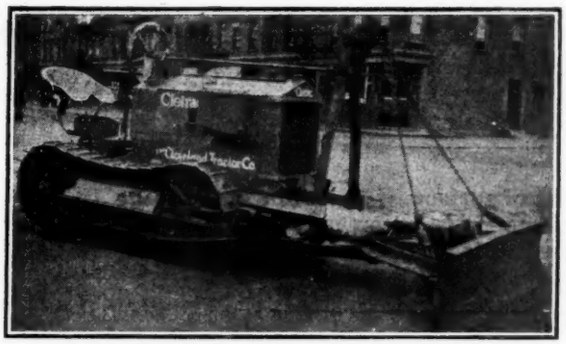
Plans and specifications have been prepared for a large garage and receiving station in Brooklyn on Water and Dock streets, with a capacity for sheltering 300 auto-trucks.

Plans are being prepared for a central repair shop and this is to be followed by the building of twenty-two garages throughout the city in the Boroughs of Manhattan, Bronx and Brooklyn, city-owned property which has been turned over to the Department of Street Cleaning for this purpose by the Sinking Fund Commission and the Department of Plant and Structures.

Co-operation of Other City Departments—In the proposed plan of co-operation between the Street Cleaning, Fire and Police Departments, it is intended to assign two policemen or two firemen to operate the caterpillar tractors, who are licensed chauffeurs, skilled in the work of operating motor-driven apparatus, who will command auto and horse-drawn truck drivers to give these tractors the right of way.

The general plan of operating these tractors, together with five-ton auto-trucks of the department, will be as follows:

As soon as a snow-fall starts and the Commissioner is convinced—after consulting with the Weather Bureau Officials—that it will be a continued storm, he will issue orders to have the tractors and trucks begin work. The plows shall be attached to the trucks at the various garages, and the police, fire and street cleaning operators who are assigned to this work shall immediately report for duty and proceed at once to the points where they are to plow.



TRACTOR PUSHING SNOW PLOW IN ADVANCE

The scheme, as outlined, is to have plows in teams of two clean a width of 20 feet of roadway for a distance of three lineal miles in one hour and to continue working over such a route after the snow has ceased falling. The average rate of snow-fall is ½ inch per hour and the motor-driven plows operating at the rate of three miles an hour, will cover the entire area every two hours, constantly plowing 1 in. of snow on each trip up and down the assigned area.

Rapid Snow Removal—With 150 tractors and 250 five-ton trucks operating, all of which will have snow-plows attached, starting at 200 different points and covering 3 lineal miles, cleaning 20 feet of roadway, it will be noted that the department will—with its own equipment—have plowed, at the cessation of snow-fall in each storm, six hundred miles of roadway in the important sections of the city, 70 per cent of which will be in the Borough of Manhattan, so that there will be no interruption of traffic such as practically paralyzed the trucking business last year and incurred the loss of millions of dollars.

This force wll be augmented by the hiring of auto-trucks to which department snow plows will be attached and it is estimated that 100 of these will be engaged working in the same manner as the department trucks and tractors covering an additional 150 miles of roadway. It is intended that this total force will be operating within one hour after the call has been issued by the Commissioner, so that if the storm is in progress one hour and it is decided to call out the force, all the equipment will be in motion within two hours after the storm starts or, in other words, the full force of motor-trucks and tractors will be operating when the snow shall have reached a depth of one inch.

The first point in the work of snow removal is to keep traffic moving. This will be accomplished by throwing the snow from the center to the sides of the roadway. The second point is to have the snow removed as quickly as possible after it is thrown to the sides. For this purpose it is intended to utilize the 100 two-ton department trucks and the department force of carts approximately 500 in number, on the first day of each storm, to haul the snow to the most convenient disposal points, such as sewers and water-front dumps.

During the progress of a storm, the laborers will be assigned to work at the same time that the call is issued for the plows to start out and they will pile the snow just as soon as it is thrown to the side of the roadway by the plows. This will obviate delay as formerly occurred while waiting for the contractor's forces to begin work, which was usually delayed until the following day.

The Street Cleaning Department intends to remove the snow with its own force south of 14th Street, in the Borough of Manhattan, where the greatest difficulty developed last year, and to extend its forces, wherever practicable, north of 14th street on the main thoroughfares, such as 5th Avenue, Broadway and other main arteries of traffic, so that the snow will be removed with all possible speed.

It is purposed to utilize the plows attached to the tractors to push snow from the roadways to the sewer manholes wherever such are available, after they stop plowing, which means that 150 tractors will be pushing snow on all streets where sewers are available and in this way great quantities will be removed quickly.

Emergency Workers—The plans also provide for registration of the emergency men in advance of the winter season in order to have an available snow-fighting force of laborers report at the 103 section stations throughout the three boroughs, at which places they will be equipped with picks, shovels and pan scrapers; and under the direction of squad leaders they will be assigned to certain routes for sewering or piling the snow, depending upon the type of sewer adjacent to the various points at which they are assigned to work.

The rates of pay to attract a sufficient number of laborers for snow-work will be determined later in the year, depending upon what a survey of the labor conditions will indicate. As it is intended to make every effort to have the snow removed quickly, a raise in the rates would seem to be one of the means of inducing laboring men to report promptly in sufficient numbers to get the work done rapidly and at a minimun expense, for it is easier to handle the snow immediately after it has fallen than to permit it to be pressed down by the traffic and hardened by freezing.

Prohibitory Cost of Paving

It is reported that the road commissioner of New Orleans has decided to abandon some of the proposed paving contracts for which the bids received are considered unreasonably high. It is considered preferable to lose a year than to pay $8 per square yard for work which formerly cost $2. A tabulation of the bids showed "entire absence of competition," and although it is not claimed that the prices asked are more than the cost of materials and labor warrant, it is felt that the figures are almost prohibitory and that the burden should not be inflicted at present on the contractor. Under the law the work already bid on must be executed or abandoned because it is required that contracts for paving must be made a year in advance and therefore this work cannot be deferred a few months.

Selecting a Type of Road Surface

A discussion of the question, "What type of surface will give the best results under a set of given conditions?" A tentative solution is proposed by the Office of Public Roads.

The general subject of selecting the type of road surface for any given highway improvement, basing such selection upon some reasons that have definite information as their foundation, was discussed before a conference of district engineers by E. W. James, assistant chief engineer of the Bureau of Public Roads.

Selection of the type of road is, he said, "one of the large and still open questions in highway engineering." Data are lacking for reaching any definite conclusion based entirely upon technical considerations. There is little or no unity of opinion as to the service value of the various types under given conditions of traffic, or regarding the probable length of life of the several types. On the basis of cost over a period of years, opposite conclusions were reached recently by two engineers of one of the large state highway departments. Data simply are not available for a purely technical answer to the question: "What type of surface will give the best results under a set of given conditions?"

Many engineers and investigators, however, are endeavoring to secure such data, chief among these being the Bureau of Public Roads, which is the only governmental organization having at its disposal funds and personnel for conducting the necessary experiments.

Aside from the technical considerations, there are and probably always will be several important administrative ones which will have considerable weight in determining type of pavement. These are the exigencies of construction (involving engineering administration), financial limitations and the influence of local opinon, which opinion is frequently influenced by the promotion work of those having materials, equipment or proprietary types for sale.

The Bureau of Public Roads has for a number of years been collecting data, probably the most valuable of which are in connection with surface treatments. It reports having found, for instance, that a water-gas tar preparation applied as a cold surface treatment, maintained under patrol, will carry 925 gross tons of traffic per day, and under this traffic the maintenance will be in the third of seven experimental sections on the basis of economy; but this same section was destroyed by 1,130 gross tons per day beyond the point of any reasonable maintenance. The average life of a retreatment of this material was found to be eight months. A hot tar surface treatment stood up satisfactorily under 1,325 gross tons daily average.

There are considerable more data of this general nature which are being collected and others which, having been collected, are now being studied and conclusions drawn. As yet, however, there is little or no material of value in the literature of highway engineering or in the engineering press relative to the determination of type. "Engineers have written all around the subject but have generally refrained from committing themselves to figures."

With respect to heavy trucking, the observations of the Bureau of Public Roads are that trucks rated heavier than three tons are generally seriously destructive of any type of pavement customarily used on rural roads up to 1917. Further, the destructiveness varies directly with the speed, but probably in greater ratio. It appears that constant use of a few trucks per day, if they are heavier than three tons and run at a speed of 25 to 35 miles per hour, is sufficient to cause high-type pavements of designs current in 1916 to fail, no matter how well they may be maintained.

During the past two years there has been a continual increase in the practice of submitting alternate designs for projects on which Federal aid is asked. Some states have adopted something like a system in selecting and even in deciding between these alternates. The state of Illinois has attempted to set up a rational method of comparing types, one essential feature of which is that, studied as a beam, a pavement cross-section constructed wholly of concrete is stronger than one with a bituminous top on an adequate concrete base; that the upper layers or wearing surface of a pavement cross-section in concrete is worth twice as much as a bituminous-top wearing surface. Incidental to this conclusion is the use of an identical mix for a one-course concrete design and for the base of bituminous-top construction. "Obviously, a rational analysis of this problem has not been made and would be of very doubtful value. It appears to involve the analysis of a compound beam of elastic material, continuously but not uniformly supported on elastic bearings, and besides the question of flexure involves consideration of no less than three different longitudinal shears, one in concrete, one in the bituminous top, and one in the joint between them. The last element cannot possibly be evalu-

ated, and the question of reduced impact owing to the cushioning effect of the bituminous top confuses the whole problem." Although this conclusion is unsatisfactory to many engineers and to a large group of material manufacturers, there has, nevertheless, been surprisingly little unfavorable criticism of it, probably because no one has any better data on which to base objections than the Illinois department had on which to base their conclusions.

The state of Pennsylvania in the 1919 specifications compared types on the basis of probable cost, and developed designs for such pavements as sheet asphalt, Filbertine and Warrenite having dimensions which departed from previous customary practice, because designed with the purpose of producing a cross-section of each type so that all would cost approximately the same. This plan possesses the inherent drawback that it must be entirely revised with every change in relative cost of materials.

The Bureau of Public Roads has tentatively followed another solution which starts by establishing a list of pavements on the basis of service value. This is purely empirical and indeterminate and likely to vary somewhat in the judgment of different engineers. The order in which pavements have been listed by the Bureau is as follows: Brick on concrete base, sheet asphalt on concrete base, cement concrete, bituminous concrete on an adequate base, bituminous macadam, surface-treated macadam, water-bound macadam, gravel macadam, gravel, sand-clay, top soil, earth.

The next step was to attempt to indicate sufficiently the details of design so that the pavements could be classified in groups. Three groups known as Classes A, B and C were selected, for heavy, medium and light traffic, respectively. Under Class A the bureau placed monolithic or semi-monolithic brick pavement, using 3 or 3½-inch block on 4-inch or 5-inch cement concrete base mixed 1:2½:5 or 1:3:6. Also bituminous concrete 2 inches thick on a 5-inch or 6-inch cement base mixed 1-3-6. Also cement concrete pavement 6 inches thick at the sides and 7½ inches at the center mixed 1-2-4.

For Class B, medium traffic, it designates bituminous concrete 1½ inches thick on a 4-inch or 5-inch concrete base mixed 1-3-6. Also cement concrete pavement 5 inches and 6½ inches mixed 1-2-4. Also bituminous concrete 2 inches thick on a 4-inch bituminous concrete base of crushed stone or gravel.

For Class C, light traffic, it designates bituminous concrete 1½ inches thick on a 4-inch bituminous concrete base of crushed stone or gravel. Also bituminous concrete 1½ inches thick on a bituminous binder course 1½ to 2 inches thick, on a 4-inch broken stone base. Also bituminous concrete 2 inches thick on a 5-inch water-bound macadam base. Also bituminous macadam 2½ inches thick on a 5-inch water-bound macadam base.

This classification was especially devised as a suggestion for the state of Idaho and there was included under Class A as a fourth alternate, bituminous concrete 2 inches deep on a 5-inch or 6-inch bituminous concrete base of crushed stone, this addition being solely for the purpose of providing in this group a type of surface that would not require water for construction. It is apparent that this classification is not generally applicable. For instance, Class A pavements should be made considerably heavier in most of the Eastern states, and numerous other variations in detail would have to be made for other localities.

"So many different questions have arisen regarding the determination of alternate and comparable types that it appears necessary to seek a solution in an entirely different direction. So far we have attempted to establish an equivalency of either cost or service value. . . .

"It has been suggested that an attempt be made to establish normal differentials among the several higher types that are likely to be brought together in competition. This normal differential presupposes the fixing of what may be referred to as a normal base price for each type on a given project, and this will be arrived at by a careful analysis of the materials entering into the construction of the design on the basis of their cost. Given a particular project on which it is intended to solicit tenders for sheet asphalt, modified Topeka, and concrete, the materials necessary to construct each type will be located and the cost of placing them into the work will be analyzed. This will provide for each type a very carefully compiled engineer's preliminary estimate. It need not represent the actual cost, but it will establish a normal basis of comparison and fix the normal differentials that may be expected to exist between various types. When the bids are opened, if the bid for concrete is below its normal base price and the bid for Topeka is above its normal base price, the concrete would be considered the better bid. If, on the other hand, sheet asphalt, although bid at a considerably higher cost, were below its normal base price, and concrete above its normal base price, the tender for sheet asphalt could logically be considered as the better bid. . . . The practical effect of this method is to avoid decision as to strictly comparable types or designs, and at the same time maintain competition. But that competition is no longer among the types; it is a competition of each type with its normal or base estimate.

"It is, of course, at once apparent that a suggestion of this kind can only be worked out under very intelligent engineering direction—it will mean that the engineer, after having selected his alternative designs, will first have to compute the quantities of cement, sand, chips, aggregate, bituminous filler and whatever other materials enter into the construction, locate probable sources of suitable materials and carefully analyze the cost of each one."

"Whether this scheme is practicable from a business point of view may be open to some question. It has some decided advantages. For instance, it has been noticed that concrete bids when brought into competition with bids for Topeka or

Warrenite on a concrete base have a marked tendency to rise until they are only slightly below the Topeka bids. If a differential were established, concrete would have to stay down where it belongs or it would be at a disadvantage. The cost of preparing preliminary estimates would be somewhat greater than at present and the estimates could not be based so generally on averages derived from records of past bids as they now are. It is probable also that a somewhat higher standard of preliminary engineering in general would be required to carry out this scheme successfully, because there would doubtless arise considerable differences, especially among material men, as to the fairness of the differentials established, and the engineer responsible for the computations would have to fortify his conclusions by very skillfully analyzed data."

Two Illinois Asphaltic Pavements

An asphaltic concrete highway pavement on a rich concrete base and a sheet asphalt pavement of unusually stiff mix are described by John B. Hittell. Materials hauled in 4-bag batches by twenty-five trucks and mixed on the job. Base roughened by corrugated roller.

Two asphaltic pavements constructed this year in Illinois were described in a paper before the American Society for Municipal Improvements by John B. Hittell, district engineer of the Asphalt Association. Mr. Hittell selected these two pavements because they represented types of construction recently designed which will carry a large amount of traffic, one being laid on a cement foundation with a rather unusually rich mix and the other containing a top mixture which was unusually stiff. One was a section of highway and the other a part of the $15,000,000 Boulevard Link improvement of Chicago.

ASPHALTIC CONCRETE PAVEMENT

The highway pavement was asphaltic concrete on a cement base. The State Highway Department of Illinois receives bids on alternate types of construction, Portland cement concrete and bituminous concrete, specifying that the latter shall be laid upon a concrete base 1 inch less in thickness than that specified for the concrete pavement and mixed in the same proportion, the bituminous wearing surface being 2 or 3 inches thick. In 1919, the state called for bids on four sections of the Chicago, Waukegan and Milwaukee road, and R. F. Conway Company of Chicago, with wide experience in the construction of all classes of pavements, was awarded contracts on two sections for asphaltic concrete and on the other two for cement concrete, the bids for the asphaltic concrete being about $7,200 greater per mile than those for cement concrete. Undoubtedly the highway authorities, in thus awarding the contracts, desired to avail themselves of an opportunity to make a fair comparison between bituminous and cement concrete highway construction, as the conditions for such comparison were ideal—the same soil, traffic and widths of roadway, a thoroughly equipped and experienced contractor, and the fact that the asphalt would connect at each end with a cement road. The asphaltic concrete section contains 85,436 square yards and is almost 8 miles long. At one end it connects with a cement concrete road 18 feet wide, 7 inches thick at the side and 8 in the center, mixed 1:2:3½. Part of the route was occupied by an old macadam highway, but this was narrower than the new road and because of the amount of grading was of practically no material value as a support for the pavement.

Long stretches of light cutting were encountered in the grading and for this a large Koehring grader was employed and at times 3-yard wagons were loaded at the rate of 75 per hour. At the end of one of the cuts where a 3-foot fill was made, the soil was such that horses mired themselves and were unable to move their loads. This was overcome successfully by employing a large caterpillar tractor hauling a train of three wagons.

In the early part of 1920 a central mixing plant consisting of two 4-bag mixers was used, the concrete being hauled in trucks 2½ miles to the point of construction. This was successful at first but had to be abandoned later owing to the inability of material producers to supply materials in sufficient quantities to operate the two mixers simultaneously.

At the time of writing this paper, August, 1920, the materials for concrete were being hauled in bodies mounted on a Ford chassis with a capacity for one batch of 4 bags of cement, sand and stone in the proportion of 1:2:3½. The truck first receives 4 bags of cement from the pile or car, then moves to the sand car where the sand has previously been shoveled into a box attached to the side of the car, from which it is emptied into the truck; which box holds twice the portion of cement and is readily moved from one point to another on the side of the car. The necessary amount of coarse aggregate is added, the amount being gauged by the size of the truck body. About 25 of these trucks were employed and were equipped with 4½-inch tires on the rear wheels which very materially helped to compact

the subgrade. In fact, the district engineer of the State Highway Department stated that there was practically no rolling of the fine grade and that the condition of the sub-grade was excellent.

The concrete base is 6 inches thick at the sides and 7 inches at the center. On tangents the subgrade is flat, while on curves there is a super-elevation of 18-foot pavements varying from 2½ inches on a 2 degree curve to 18 inches on a 7 degree.

A Lakewood mechanical tamper has been used, but at the time of writing the compression was being obtained by a large wooden tamper operated by two men, one on each side of the roadway. The specifications called for no curbs, but the contractor and officials agreed upon constructing a curb 4 inches wide and about 3 inches high integral with the foundation.

Last fall, when work was first started, brooms were used to roughen the surface of the concrete and increase the adhesion of the asphalt, but this method was soon superseded by a hand roller designed by G. N. Lamb, district engineer of the State Highway Department, which consists essentially of 5 feet of 10-inch wrought iron pipe sealed at the ends, to which has been attached at intervals of 5 inches ordinary 1-inch angle irons.* The roller is operated by two men, one on each side of the roadway, and the corrugations are made at an angle of about 60 degrees each way from the center line of the road, leaving the surface grooving roughly diamond shaped. The result has been very satisfactory. The concrete is cured by use of wetted tarpaulins and afterwards by flooding, no earth embankments being used, however, as is is not considered possible to satisfactorily remove the earth afterward from the rough concrete.

The average progress of the concrete foundation was over 400 feet a day. Four thousand feet of finished roadway was laid in 1919. Concreting was started September 24, while binder and top were laid during the week of November 20. Owing to the lateness of the season the contractor ran these materials from a plant in Chicago, hauling it 17 miles in 7½-ton trucks. The penetration of the asphalt varied between 56 and 68.

In order to finish more than 7 miles of binder and top this year, the contractor has installed at Deerfield a 1-car Cummer plant with a capacity of about 200 tons or 700 lineal feet of completed bituminous pavement. Two tanks of about 18,000 gallons capacity, one for fuel oil and one for asphalt cement, will be used to guard against interrupted delivery of these materials. The haul will average 2 miles. The mixture for the binding course is composed of asphaltic cement, stone chips and fine aggregate, there being from 4½ to 6½ per cent of bitumen, 15 to 30 per cent of mineral passing 10-mesh, 40 to 70 per cent passing 2-mesh and retained on 10, and 10 to 30 per cent passing 1-mesh and retained on 2. The wearing course consists of coarse aggregate, fine aggregate, filler and asphaltic cement, there being 7½ to 9 per cent of bitumen, 7 to 10 per cent mineral passing 200-mesh, 20 to 30 per cent passing 40, 25 to 35 per cent passing 10, 8 to 22 per cent passing 4, less than 10 per cent passing 2-mesh and retained on 4, and 18 to 32 per cent passing 2 and retained on 10.

This road begins 19 miles from city hall, Chicago. A traffic count was taken on Sunday and Monday, August 8th and 9th, by George A. Quinlan, county superintendent of highways, on this avenue 15 miles from the city hall. There were counted 11,991 pleasure cars and motor trucks from midnight to midnight on Sunday and 2,721 on Monday; about 5 per cent of the total on Sunday being motor trucks and about 10 per cent on Monday. Probably any other day of the week would have shown more motor trucks. The Illinois motor vehicle law limits the maximum load on any axle to 16,000 pounds, although cities may increase this by 50 per cent within their own limits, and permits may be issued for specially heavy loads. When frost is leaving the ground, officials may prohibit the operation of vehicles having a gross weight of more than 5,000 pounds.

SHEET ASPHALT PAVEMENT

The sheet asphalt pavement is on the north and south approaches to the new Boulevard Link bridge, being laid in connection with the widening and extension of Michigan avenue from Pine street to Randolph street, Chicago. The roadway of the bridge is 54 feet wide and the approaches are 75 feet and 80 feet, respectively. 17,850 square yards of the sheet asphalt was completed in 1918 and the remainder was finished early this year. The specifications called for a concrete base 8 inches thick mixed 1:3:6; a binder course 1½ inches thick and a wearing surface. The binder contains stone from 1 inch down, sand and bitumen, there being 4 to 7 per cent of bitumen and 20 to 30 per cent of material passing a 10-mesh screen. The surface mixture contains about 10½ per cent of bitumen, 18 per cent of mineral matter passing a 200-mesh sieve, 21.6 per cent passing an 80-mesh, 38.2 per cent passing a 40-mesh, 10.5 per cent passing a 10-mesh, and 1.2 per cent passing a 4-mesh. On level stretches the crown on the 80-foot roadway is 10 inches with a parabolic curve, reducing to 9 inches on gradients. The contractor guaranteed the work for two years from acceptance, agreeing to keep it in perfect repair during that period.

This improvement was made solely to accommodate pleasure-car traffic between the two sides of the river and to provide separate roadways for commercial traffic to and from the railroad freight yards. Speeds of 25 to 30 miles are common. Busses weighing 10,500 and 11,500 pounds empty, with ordinance capacity of 50 and 60 persons, use the pavement regularly, while an even heavier one is now operating under temporary permit. On Sunday, February 29, 1920, 9,400 automobiles were counted on this road between 10 a. m. and 7 p. m. On the same road 900 feet further north of Chicago avenue on Sunday, July

*A photograph of this was shown on the cover of last week's issue.

25, 12,700 automobiles were counted; and a count made on August 11 at another point on this avenue showed 36,665 between 7 a. m. and 7 p. m., averaging 50 per minute.

Autoists Leave $74,000,000 in California

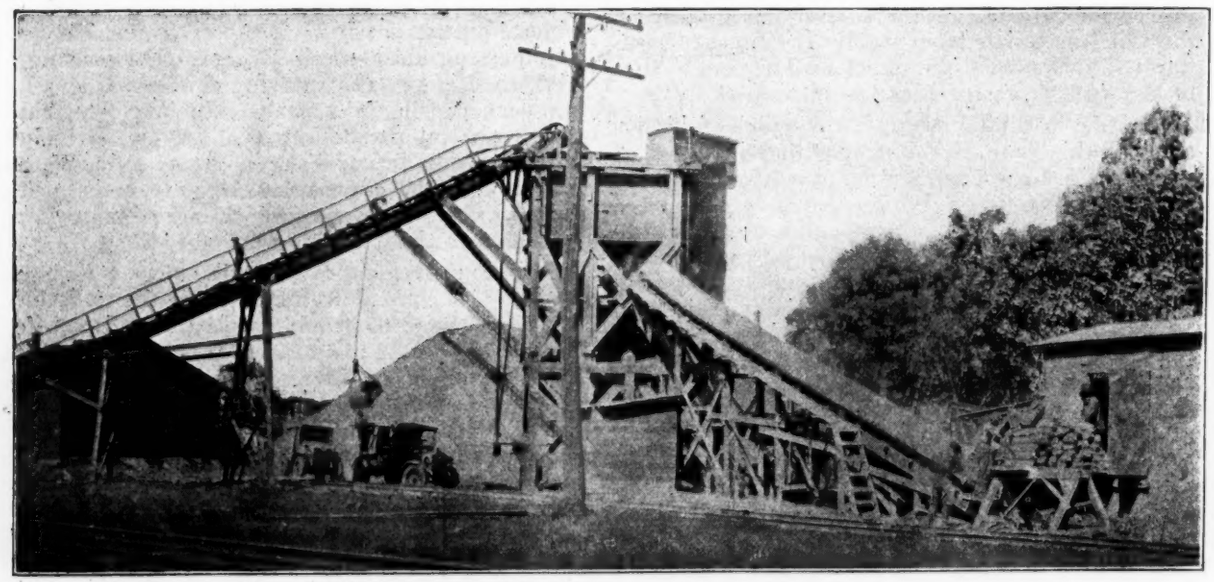
The State Motor Vehicle Department of California recently issued a statement that during the first six months of this year, 62,000 non-resident licensed permits were issued, and it is estimated that double this number will be issued for the entire year and that, estimating an average of four persons per car, an average stay in the state of one month (although many automobile tourists remain several months), and an average expenditure of $5 a day, this gives an estimated expenditure by visiting motor tourists during 1920 of $74,000,000. The California State Automobile Association believes that nothing like this number of tourists would be attracted to the state were it not for its excellent highways and that this amount can therefore be credited to the state highways as a partial offset to the cost of constructing and maintaining them.

Record Output for Central Concrete Mixing Plant

A paving contractors lays 355 cubic yards of seven-inch concrete pavement in a day, later increasing this to 425 with a maximum haul of 3¾ miles from a central mixing plant. This record was obtained by carefully planning and synchronizing every part of the work of transporting, mixing and spreading the concrete.

It is claimed that the world's record for a single day's production of concrete for paving work by a central mixing plant has been established by McCree, Moose & Co. of St. Paul, 912 lineal feet of 18-foot road averaging 7 inches thick, containing 355 cubic yards, having been laid by this company's central mixing plant in 10 hours. The record using the paving mixer method is said to be 308 cubic yards in 10 hours, made by Alan J. Parrish of Paris, Illinois. The state specifications on both jobs required a full minute mix per batch. These records would seem to indicate that the central mixing plant method can produce paving concrete with 15 per cent more speed than the paving mixer method.

The McCree, Moose & Co. contract covers 7½ miles of road running north and south from Big Lake, Minnesota, where the central mixing plant was located, giving a maximum haul for the mixed concrete of 3¾ miles. The roadway is 18 feet wide, 6½ inches thick on the sides and 7½ in the center, mixed 1:2:4. (The Minnesota state specifications required 1:2:3½ unless a machine tamper and finisher is used, in which case 4 parts of coarse aggregate may be used). The specifications for consistency require that the concrete, when placed and tamped in a cylinder 6 inches in diameter and 12 inches high and the form removed, shall have a vertical settlement of not more than 2 inches when machine finishing



CENTRAL MIXING PLANT. LOADING HOPPERS WITH SAND, CEMENT AND STONE.

is employed and not more than 6 inches when hand finishing is employed. As machine finishing was employed on this work, a dry mix was necessary.

The specifications require that concrete shall be mixed until it is homogeneous and uniform in color, remaining in the mixer at least one minute, and while the drum makes not less than 12 nor more than 18 full turns; requiring the mixers to be equipped with a timing device. The contractor used a 1-yard Smith tilting mixer and connected to this a batch meter of his own make which rang a bell at the end of the required number of revolutions of the drum but did not register the number.

This mixer had been used by A. Guthrie & Company in 1916 on the Calumet Sag channel, being then equipped with an electric motor. It was purchased by the present contractors and on the job herein described the power was transmitted by a long belt from a motor mounted near the ground.

At the central plant the cement in bags is unloaded direct from the cars into a warehouse. A belt conveyor leads from here to a hopper, which is directly over the mixer. The bags are opened in the warehouse and the cement, 6 bags at a time(this being the number required for 1 batch), is dumped on the belt conveyor which carries it up to the cement hopper.

The sand is brought from a pit 1¾ miles away by 2½-ton end-dump trucks, which deposit it through a trap on to another belt conveyor which elevates it to a second hopper which is located over the mixer and which has a capacity of 20 yards.

Crushed St. Cloud granite, which is used as coarse aggregate, is shipped to the plant in gondolas. A 1-yard clam-shell bucket on an 85-foot boom derrick unloads it from the cars directly into a third hopper placed over the mixer, which has a capacity of 25 yards. Additional crushed stone is unloaded into a stock pile behind the derrick, and the hopper is kept supplied from this pile.

Under the three hoppers is the batch hopper of the mixer, sub-divided to hold the correct proportions of sand, cement and crushed stone, which are fed into it from the hoppers above.

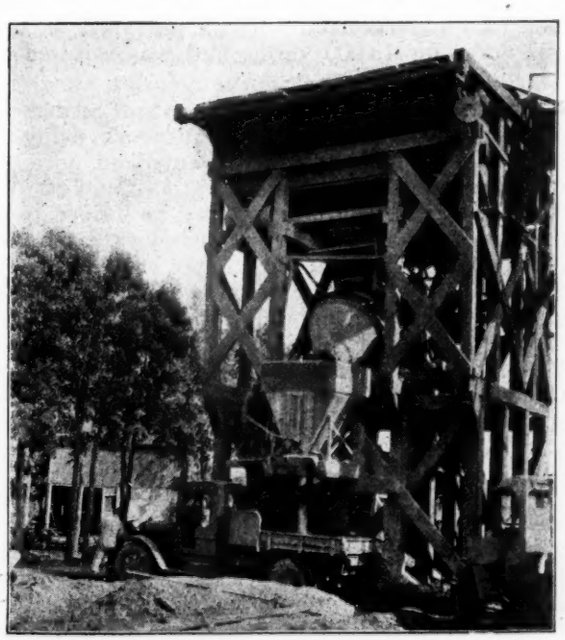
After having mixed the ingredients one minute, the mixer discharges the entire batch in 8 seconds into a bottom-dump hopper arranged just high enough to permit the trucks to drive beneath it, and having a capacity of 2 cubic yards of mixed concrete.

The mixed concrete is carried to the road by motor trucks of 2½ tons capacity, with specially short wheel base and equipped with end-dump bodies manufactured by the Lee Trailer & Body Company. They have a level capacity of 2 yards but were usually loaded with about 1½ yards of concrete.

After being dumped upon the sub-grade, the concrete is spread by horse-drawn scrapers and is tamped and finished by a finishing machine. The road is cured by the ponding method.

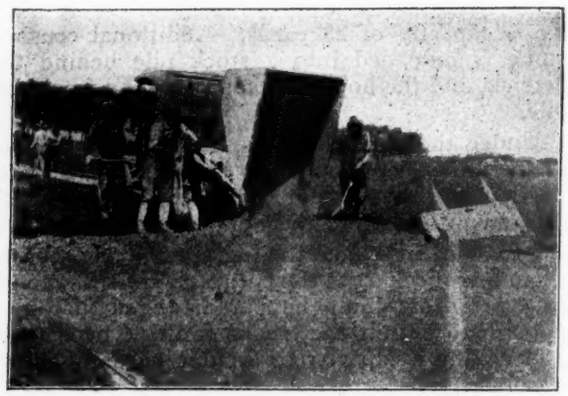
In carrying out the construction work, concreting was begun a mile and a half north of the mixing plant and carried toward the plant; then was begun a mile and a half south of the plant and carried north to join with the other section. Work was then started at the extreme northern end of the road and carried down to join with the first section, then at the extreme southern end working toward the second section. This enabled the trucks, during the construction of the third and fourth sections, to travel for a mile and a half over the new concrete road.

It was found that the amount of pavement laid depended upon the transportation facilities for



MIXER DISCHARGING INTO TRUCK WITH ORDINARY DUMP BODY, AT CENTRAL MIXING PLANT.

DUMPING CONCRETE FROM ORDINARY DUMP BODY TRUCK NOT ENTIRELY SATISFACTORY. NEEDS PERSUASION TO DISCHARGE ITS LOAD.



DUMPING CONCRETE FROM LEE END—DUMP BODY

handling the concrete rather than upon the mixing plant itself. Had more trucks been used the record made could undoubtedly have been exceeded. The amount and number of trucks also were governed by the distance from the plant. When paving not more than half a mile from the plant, 883 lineal feet was laid in one day using only 4 trucks. The 912-foot record was made on the end section, using 7 trucks traveling for 1½ miles over the completed concrete road. The contractor on this job also made an average daily record of 11,000 square yards, or 550 lineal feet, over a period of several weeks.

Comparing the central mixing plant method with the paving mixer method, it should be noted that the paving mixer had a capacity of ¾ yard of mixed concrete and was turning out a 1:2:3½ mixture instead of a 1:2:4. On the other hand, the central plant was somewhat handicapped by insufficient facilities for transporting the mixed concrete and therefore was not run at full capacity.

.. Since we wrote the above, these contractors have established a new record of 1,094 feet, or 425 cubic yards, of concrete in 8 hours. The company has finally gotten 12 trucks on the job and is expecting to exceed this record and may have done so before this article is read.

Machine Ditching Economical in Soft Ground

A drainage ditch has been constructed by the St. Louis and San Francisco Railway at Harvard, Ark., from 2 to 8 feet deep, 3 feet wide at the bottom and with side slopes of 1½ to 1, which required about 4,200 yards of excavation. It was originally intended to do the excavating by team work at an estimated cost of 60 cents per yard, but when the railroad forces arrived to execute the work it was found that the ground was so soft that the horses could not work on it, and it was concluded to try an American railroad ditching machine.

As the weight of the machine was too great to be supported directly on the ground, there was provided a special track supported on the center line of the ditch by movable sections of timber grillages or platforms that distributed the load equally to both sides of the ditch. Three sections of the platform, each 10 feet long, were made with an 8 x 10-inch transverse beam 16 feet long, supported at each end on a pair of longitudinal 3 x 10-inch planks 10 feet long, set close together. An 8 x 10-inch longitudinal stringer timber was placed flat under each rail and bolted on top of the transverse timbers. On these stringers 66-pound rails were spiked to suit the gauge of the ditcher machine.

A bearing of 32½ square feet was thus provided on the surface of the ground by these platforms and proved adequate to support the ditcher machine, which handled the platforms without difficulty, shifting the sections successively from rear to front as it progressed.

At the deepest part of the ditch the span of the track platform did not suffice for the ditch to be dug full width at the top. It was therefore dug to full bottom width and full depth and to partial top width, after which the ditcher machine advanced and, turning around, completed the ditch in the rear by widening it to the proper slope.

The total cost of executing this work in this manner was $550, or only slightly more than one-fourth of the estimated cost of doing it by teams. The cost of coal, oil, timber platform, installation and removal of ditcher was $85 and the remainder was for the wages of one ditcher operator, one ditcher fireman and one laborer for one and one-half months.

Improvised Dredge

Adjacent to an iron ore dock at Marquette, Mich., the depth of the water had been decreased from 23 feet to 16 feet by spilling the ore that was unloaded there and by accumulation of rubbish, so that it was necessary to dredge it out. The best bid received was $1 per yard with a guarantee for 15,000 yards, and was rejected as too high.

The dock company thereupon proceeded to deepen the water by force account work, using an American ditcher machine mounted on portable track sections on the deck of a 22½ x 50-foot barge. The ditcher was secured in a fixed position on deck and was equipped with a ¾-yard clamshell bucket. Besides removing the ore, it also brought up a large quantity of miscellaneous material, including boulders, wire and Manila rope, timbers and rubbish. It loaded into a bottom-dump scow of 30-yard capacity and had no difficulty in dredging to a depth of 23 feet at a cost of 40 to 50 cents per yard of material excavated. The bucket was operated at an average of one round trip per minute and at a maximum speed of 35 seconds. The material was excavated an average depth of 20 feet and lifted 12 feet above water, and as there was only one scow employed, considerable time was lost in the 20 or 30 minutes required to dump the scow and return it, after which about 1 hour was necessary to fill it.

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Machinery for Snow Removal

Five years ago the use of machinery other than trucks in removing snow was so unusual that any instances of trials of such were published as novelties. Even for city streets, little use was made of anything other than horse-drawn plows or scrapers for shoving snow to one side, and only a few of the larger cities employed these; while in country roads little attention was paid to anything except the deeper drifts, and these were almost invariably cut through by hand.

How much development there has been in the past two or three years in the use of machinery for handling snow is indicated by the fact that New York, Philadelphia and other large cities are ordering snow plows, tractors and other machines by the hundred for removing snow from the streets; but even more by the extent to which the states themselves are preparing to keep the highways in the country districts open for traffic during snowy seasons. The State Highway Department of New Jersey owns 22 snow plows, but a few days ago authorized its engineer to advertise for 55 more. Massachusetts has bought 60 snow plows together with the fittings for attaching them to different makes of trucks.

In most cases the machinery so far adopted for regular use is confined to snow plows drawn by horses or trucks or pushed by trucks, but experiments are being made with numerous other devices such as rotary plows for throwing the snow entirely off of the roadway and adaptations of the elevating grader for lifting the snow from the roadway and discharging it directly into trucks.

One of the serious objections to making large investments in snow-handling machinery is the large amount of money tied up twelve months of the year which serves a useful purpose for only as many days or even less. It is highly desirable that machinery be used in the snow handling that can be used for other work during the summer; or be so constructed that the most expensive part of the machine can be used in ordinary summer work of highway and street departments.

Mix for Concrete Base

In a paper in this issue entitled "Selecting a Type of Road Surface," reference is made to the practice of the Illinois Highway Department of specifying the same mix for a one-course concrete pavement as for the base to receive a bituminous wearing surface. The engineer of the Bureau of Public Roads from whose discussion this was quoted states that this specification is not satisfactory to many engineers, but that they have no better data on which to base objections to it than the Illinois department had on which to base their conclusions.

In another article, also in this issue, entitled "Resurfacing Concrete Roads," the author holds that a very dense concrete is not so suitable as a base for asphaltic pavement as is a concrete of leaner mixture, and that a 1:3:6 concrete base is better under an asphaltic top than the richer mixtures used for concrete pavements; giving as his reason that the richer mixture is more susceptible to temperature changes and to developing cracks. In support of his opinion on this point he quotes a member of an engineering firm of wide experience in pavement work, who has formed his opinion from many years of observation.

There would therefore seem to be a decided difference of opinion on this point, which is certainly an important one in view of the millions of dollars being spent every year in constructing concrete base and utilizing concrete pavements as a base for bituminous top. If the state of Illinois, in requiring twice as much cement per cubic yard of base as is used by others, is not securing any better base and possibly even not so good a one, it is certainly desirable that it save the additional cost of the richer concrete.

line of the ditch by movable sections of timber in it.

It seems to have been the experience of engineers in other lines as well, that rich concrete develops more cracks than that which is somewhat leaner. For instance, it has long been claimed by sewerage engineers and contractors that a cement joint in a sewer pipe is tighter if mixed with one or two parts of sand than if neat cement be used, the latter being more apt to develop cracks which cause leakage. On the other hand, test samples of cement mortar generally indicate greater strength for those which contain the larger amounts of cement.

It has for some time been the writer's opinion in connection with the sewer joints, that the explanation lies in the probable fact that with mortar mixed with 1 or 2 parts of sand, the aggregate amount of cracking is perhaps as great as with the neat cement, but is distributed over a very large number of minute cracks, none of which is sufficiently large to be visible or to permit leakage through it; while with the neat cement the strength of the cement and the absence of the surfaces of sand particles along which cracks may form cause a tension throughout the entire ring of the joint which finally ends in a few large cracks developing at the points of least strength.

Similarly it seems probable that the same takes place in a concrete pavement. With rich concrete causing greater strength, internal tension is developed which results in cracks at considerable distance apart; while the leaner concrete, under similar conditions of shrinkage during setting, develops a large number of minute cracks which do not appear upon the surface nor affect the bituminous top, and to this extent the leaner concrete is probably preferable. It seems extremely probable, however, that in beam strength the leaner concrete is weaker, especially if the numerous fine cracks form as suggested, and that if such strength is a necessary or desirable characteristic of a foundation for such a surface, then in this respect the richer concrete would be the better base. The part that beam strength plays in supporting pavement surfaces is something concerning which we have very little information, although data now being collected should increase our knowledge on this point.

Undoubtedly many engineers and practical highway men have past experiences on which to base opinions pro and con on this subject, and our columns are open to a discussion of this subject from both theoretical points of view and based on experience. That it is an important one needs but a moment's consideration, in view of the thousands of miles of concrete base which is being laid every year in this country.

Comparison of Cost-Plus and Lump-Sum Building Contracts

In a discussion before the American Society of Civil Engineers of various forms of contracts, J. P. H. Perry, vice-president of the Turner Construction Co., stated that in the experience of that company, lower unit costs are obtained on the cost-plus basis than on the lump-sum basis.

Since May, 1902, that company had erected nearly 600 reinforced concrete factories, warehouses and other industrial buildings, executing about 750 contracts, about half of which have been lump-sum and the others cost-plus type contracts.

In 1917, the company built 22 factories or warehouses at a minimum cost of more than $100,000 and an average cost of $413,000. Thirteen of the buildings were built under the cost-plus form of contracts and nine of them were built under lump-sum contracts. The comparison of the two forms of contracts was based on a consideration of the three principal items of labor cost, (1) carpenter and labor work per square foot of floor required for placing and removing floor forms, exclusive of cost of making the forms; (2) cost of labor per cubic yard for all work in connection with mixing and placing concrete; (3) cost of labor for receiving, handling, bending and placing steel reinforcement.

The proper distribution of cost under these items was checked by the additional consideration of general expense as a percentage of the total payroll for each job, which varied by only about ½ of 1 per cent of the total cost.

Percentage jobs were cheaper than lump-sum jobs by 8 per cent for item 1 and by 2 per cent for item 2, and lump-sum jobs were the cheaper by 5 per cent on item 3 in the metropolitan district and by 2 per cent on the same item in districts outside the metropolitan district.

Mr. Perry considered that the cost-plus form of contract established a sort of partnership between owner and contractor and that each of them is more willing to make concessions and changes to secure greater efficiency and economy.

New York City Raises Salaries

Under a recent general readjustment of salaries, the city of New York has increased the compensation for all positions carrying a salary less than $7,500 per year. This will result in the following salaries to the engineers employed by the city: Twenty chief engineers will receive $7,450, fifty engineers will receive $4,470, eighty-six senior assistant engineers $3,420, one hundred seventy-one assistant engineers $2,760, fifty-six junior assistant engineers $2,370, sixty-four senior aids (chief instrument men and chief draftsmen) $1,700, two hundred eighty-five aids (instrument men and draftsmen) $1,500, and one hundred fifty junior aids (junior draftsmen and rodmen) $1,030.

These recent increases vary from 2 per cent in the case of the highest salary to 67 per cent for the lowest salary. Some time ago a committee on classification and compensation of engineers of the Engineering Council recommended salaries for these positions, and the salaries given above are substantially greater than those recommended for the two lowest grades, somewhat lower than those recommended for the three highest grades, and practically the same for the three medium grades.

Resurfacing Concrete Roads

By A. D. Stivers, M. Am. Soc. C. E.*

The writer believes that it is less economical to build a concrete pavement and resurface it with asphalt after a few years than to build an asphalt pavement at first, and that a leaner concrete than a pavement mix makes a better base.

Many highway engineers about to construct concrete roads contemplate re-topping these roads at some future date with an asphalt surfacing This idea seems to be quite general even among those engineers who favor concrete roads to the exclusion of all other types. The past history of concrete roads and street paving in the United States certainly contributes to this belief. Recent developments in California and Maryland seem to indicate that it is easy to delay this resurfacing too long until the concrete becomes so disintegrated that it is not a fit base for asphalt pavement.

When a concrete road is subjected to traffic for a few years its original surface becomes roughened, slowly at first, and then more rapidly as the impact caused by the drop of the wheel load becomes greater as the depth of the depressions in the road surface increases. When the surface of the road becomes so rough as to cause inconvenience to traffic it is frequently decided to resurface the road and some form of asphaltic mixture is usually selected for this resurfacing.

The original concrete road then becomes merely the concrete base for an asphalt pavement. As such, the resistance of the concrete surface to abrasion is not important. Its function is merely to distribute the load of the traffic to the subgrade and to bridge over such weak spots as may exist in the latter.

The specification most frequently recommended for concrete roads at the present time is one part of cement to one and one-half parts of fine aggregate to three parts of coarse aggregate. This produces a concrete which is very dense and very susceptible to temperature changes, and which usually develops both transverse and longitudinal cracks soon after it is constructed. Prices for this class of work have recently shown a decided upward trend in this locality (Texas). During the past few months many bids have been rejected as being too high.

This very dense and high priced concrete is not as suitable a base for an asphaltic pavement as concrete of a leaner mixture. The latter is not so susceptible to temperature changes and does not develop cracks as readily as the former. Aside from all conditions of cost, a comparatively lean mixture produces a concrete base better suited for asphaltic pavements than the rich mixture now used in almost all concrete roads. It consequently follows that the worn out concrete road resurfaced with an asphalt mixture is not as good a road as one originally constructed as an asphalt road on a base of 1:3:6 or 1:3½:7 concrete. This class of pavement base has given entire satisfaction in the past in many of our large cities and will give as good service on country roads as it has on city pavements.

Economy also favors the construction of a lean concrete base surfaced with an asphaltic mixture rather than a rich mixture concrete road to be resurfaced in a few years. Construction costs vary so widely in different parts of the country that it is impossible to consider this phase of the question in any but general terms.

A recent report of the Board of Estimate of New York City gives the average life of an asphalt surface under heavy traffic as eleven years. Adding to this the four or five years the concrete road will serve without resurfacing, gives the total life of the concrete road and resurfacing as fifteen years. The cost per mile per year of the concrete road resurfaced with asphalt is now from 15 to 35 per cent greater than the asphaltic road with a life of eleven years. Any engineer can easily work out the difference in cost for his own road when he has exact construction figures for his own locality available.

The trend of cement prices seems to be upward rather than downward at the present time and the difference in cost in favor of asphaltic construction will probably be greater in the future. If an engineer in charge of the selection of the type of surface for a heavy traffic highway believes that a concrete road is worth its cost for a few years of use and when it is worn out intends to completely rebuild it, he is entirely justified in recommending this type of construction. On the other hand, if he believes that this concrete road will soon have to be resurfaced with an asphaltic mixture resulting in an asphalt road inferior to one originally constructed as such, is he justified in recommending a 1:1½:3 base for an asphalt pavement?

(After the above had been written but before it was submitted to us for publication, it was read by some one presumably familiar with engineering principles, who criticized as fallacious the statement that rich concrete cracks more readily than lean. Wishing to be sure of his ground, the manager of the Asphalt Sales Department of the Texas Company wrote the following letter to A. W. Dow, of Dow & Smith, chemical and paving engineers, who made the reply printed herewith. —Editor.):

Mr. A. W. Dow,
Care Dow & Smith,
31-33 West 23rd Street, New York, N. Y.

Dear Sir:

One of the members of the Asphalt Sales Department has prepared a paper entitled "Resurfacing Concrete Roads" in which he makes the point that it is wrong for an engineer to design a high-class concrete road with the thought that two or three years from now, when the road starts to crack or shows signs of wear, he can cover

*South-Western division, asphalt sales dept., The Texas Company.

the concrete pavement with a sheet asphalt wearing surface. The paper points out that for practically the same amount of money a lean concrete mixture can be used in the foundation for the sheet asphalt wearing surface and that the total cost of the two would not greatly exceed the cost of the original rich mixture used in the concrete pavement and, further, that a lean mixture wearing surface makes a better foundation than the rich mixture. I quote below from his article:

> "This very dense and high-priced concrete is not as suitable a base for an asphaltic pavement as concrete of a leaner mixture. The latter is not so susceptible to temperature changes and does not develop cracks as readily as the former. Aside from all conditions of cost, a comparatively lean mixture produces a concrete base better suited for asphaltic pavements than the rich mixture now used in almost all concrete roads."

It is my recollection that in recent conversation with you on this subject you agreed with the writer of the article that a lean mixture is to be preferred.

Would be glad to have your comment on this feature.

Yours truly,
(Signed) W. H. KERSHAW, *Manager*.

New York, October 15, 1920.

MR. W. H. KERSHAW,
Asphalt Sales Department, The Texas Company,
17 Battery Place, New York City.

Dear Sir:

Your letter of October 8th was duly received, and I would say that I am in hearty agreement with the paper entitled "Resurfacing Concrete Roads" as far as you have quoted therefrom; that is, I do not believe that rich concrete is as satisfactory for foundation for bituminous pavements as is a lean concrete. I would not advise a concrete for this purpose richer than 1:3:6 or possibly, if the stone was of one size and coarse, a 1:3:5 mixture.

In a recent letter which I wrote to the *Engineering News-Record* and which was printed in their issue of March 11, 1920, criticizing an article by Captain Besson, I say that:

> "I do, however, wish to emphasize the fact that concretes 1:2:5 and richer are not only unnecessarily expensive but are undesirable for bituminous paving foundations. It is well recognizeed that rich concretes are much more liable to crack than lean concrete and these cracks not only weaken the foundation but often cause corresponding cracks in the wearing surface."

In February, 1919, in answer to a query on this subject from Mr. Linn White, chief engineer of the Chicago South Park Commission, I informed him that I could see no advantage in using a concrete as rich as 1:2½:5 and that my personal observations had led me to believe that foundations of rich concrete crack more easily and more frequently than those of lean concrete. Mr. White wrote me in reply and stated that my opinion agreed entirely with his own observations.

There are a number of engineers of long experience in concrete construction to whom I have spoken within the past few years on this very subject, who thoroughly agree with me, that rich concrete cracks much more readily than does lean concrete. One engineer, of whom I think very highly, said that he did not know of any one of experience who could think otherwise. It seems to me only necessary to compare the present rich concrete road surfaces which are being laid throughout the country with the leaner concrete foundations which have been constructed for bases under bituminous pavements in order to fully substantiate the fact that these rich concretes crack more readily than do lean ones. From a careful study of the subject it is very evident that these cracks do not come from the settling of the foundation owing to a giving way of the sub-grade, nor are they necessarily due to upheavals from frost, as this phenomenon takes place in the South, where there is no frost, to as great an extent as in the North. In the fall of 1917 I was examining some concrete laid preparatory to surfacing with sheet asphalt on a country road, and when the engineer informed me that it was a mixture of 1:2:4, I warned him that it was a dangerous mixture to use because it was much more liable to crack than a poorer concrete and would recommend him in future using a 1:3:6 mixture. It just happened in this particular case that, owing to delays caused by war conditions, the concrete was not covered with wearing surface until the following spring. At that time it was found to be cracked in many places both transversely and longitudinally. I believe that many engineers are making a mistake in laying concrete roads at the present day in the expectation that when they begin to wear or crack badly they can then surface with a bituminous surface. Such worn out or cracked concrete is surely not a desirable foundation and can only result in the early failure of a bituminous surface laid over them.

Very truly yours,
DOW & SMITH,
By A. W. Dow.

Digging a Ditch With Dynamite

By G. G. Means

Grand Lake, Minn., contains about three square miles of water and connects with two other small lakes along the side of which runs an expensively constructed highway. Owing to excessive rains, this lake rose two feet higher than normal and backed into the other smaller lakes, which thereupon overflowed and damaged a considerable part of the highway. John J. Harrison, the district engineer, asked that the water level of these lakes be lowered the two feet by which they had been raised, and lowered quickly.

On one side of Grand Lake was a large swamp which drained into a creek and was divided from the lake by a bank about 30 feet wide and two or three feet higher than the level of the creek. It was decided that the best way of lowering the water was to cut a ditch from the lake to this swamp and allow it to drain into the creek which drained the swamp.

It was impracticable to use hand or team work in digging the ditch and it was decided to excavate it by use of dynamite. A line of holes was put down 18 inches apart and 4½ feet deep. Four cartridges of straight NG dynamite 1⅛ x 8 inches were loaded in each hole, a blasting cap and length of fuse being placed in the middle hole of the row. The charges in all the other holes were set off by the concussion caused by the detonation of the primed charge in the central hole. The result of this blast was a ditch 10 feet wide at the top, 6 feet wide at the bottom and about 5 feet deep. Water immediately rushed through the ditch in large volume and cleaned it out thoroughly and during the next few days considerably enlarged the ditch so that no shovel work was required. Another ditch was dug twice as wide and of twice the capacity by putting down two parellel rows of holes 3 feet apart, the holes in the two rows being staggered and being 18 inches apart in each row. A primed charge was placed at mid-length between the two rows and both rows discharged by the one blasting cap.

The soil at this place was black muck saturated with water and underlaid with a solid layer of sand. Had it been dry or even moist ground, the use of dynamite in this way would not have been successful. As it was, the ditch was opened up clean down to the sand. The work was done hurriedly and the amount excavated was not measured nor was the cost figured exactly, but it was estimated to have been about 15 cents a cubic yard. With the opening of these ditches the lake rapidly lowered and it became possible in a few days to make permanent repairs to the road.

Columbus Municipal Reduction Plant

By Walter D. Bee*

A few points learned during the ten years' operation of this plant—how to prepare tankage to obtain the highest market price, the purchasing and recovery of solvents, and the relation between garbage and the plant products.

In treating garbage at the municipal plant of Columbus, Ohio, the garbage is first cooked with live steam, then pressed through continuous roller presses. Tank liquor from the presses goes to the grease separating tanks and from these to storage. The tank liquor is drawn from storage as needed and passed through vacuum evaporators. Solids from the roller presses go through the first dryer, and then to the percolator for final de-greasing with gasoline. After percolating, the tankage is mixed with all the stick liquor it will hold, and again dried, the final operation being sizing and grinding.

PREPARING TANKAGE

The first point to be covered is the manner of drying the tankage so as to produce a merchantable article. At the Columbus plant the tankage is dried twice, as above noted. As it comes from the presses the tankage contains from 65 per cent to 75 per cent of moisture. This moisture content is reduced in the first drying to about 10 per cent or 12 per cent, or dry enough for the material to be "wetted" with gasoline.

After final de-greasing with gasoline as the solvent, the tankage is passed over a one-half-inch mesh screen, all material too large to go through the openings being rejected as of no further value. That which goes through the screen is then conveyed to the mixer where enough stick liquor is added to make the mixture so thin that it will "run" rather than "pile up." This makes a pretty wet product to dry in one operation, but we do it in a direct-heat dryer and the tankage comes out as a hard, granular substance with an average of about 3 per cent moisture.

It has been our experience that the mixing is the particular place where both the quality and the weight of the finished tankage may be most easily influenced. The more stick that can be added, the better and heavier will be the resulting tankage. The average annual analysis of Columbus tankage runs about 3¾ per cent ammonia, 1 per cent potash, and 7½ per cent bone phosphate, and we receive very few dead animals to help boost the ammonia.

Since learning the importance of the stick in the finished product, we have been able to command a better market at a much higher price than is obtained for other tankages which have not been so carefully manufactured. In fact, we are at present getting almost as much per unit as is being paid for high grade animal tankage.

SOLVENTS AND THEIR RECOVERY

The second point to be discussed is that of solvents and their recovery. Gasoline has always been used at the Columbus plant, and up to the time this country entered the war there was no particular difficulty in securing the grade desired. During the war, however, we had to take what we could get and be glad we got it. The result was that there was considerable loss of solvent due to high boiling points.

Last year and this we have been able to get a good grade of gasoline by carefully specifying what we wanted and then distilling a sample from the car to see if it was up to specifications. Several cars have, during the last ten years, been rejected and turned back to the refiners because of high end points. As our power plant operates at 115 pounds steam pressure without superheat, we are limited in the temperature we can obtain in the percolator when "steaming out."

We specify a straight-run gasoline which will distill off at least 95 per cent at 300 degrees Fahrenheit, and then watch the car sample to see that the distillate comes off reasonably uniform. Ordinary motor car gasoline does not distill readily with steam, and in addition is not nearly so good a grease solvent as the "high test" variety. Our loss of solvent averages a little more than one gallon per ton of garbage treated, and has varied considerably from year to year, due to condition of plant and grade of gasoline used.

GARBAGE

As a last point for discussion, I believe a short review of general garbage conditions during the last ten years in Columbus will be of interest and show to what extent the people responded to the appeal to conserve food during the war.

Up to, and including 1916, the city collected garbage once a week during cool weather, and twice a week through July, August and September. Beginning with the year 1911, the garbage increased from 190 pounds per capita to 218 pounds in 1915. In 1916, the last year of twice-a-week summer collections, the decrease started with 203 pounds per capita. Since 1916, collections have been on a weekly schedule throughout the year, and the slump continued to 1918 with a per capita of 138 pounds. Last year showed an increase to 157 pounds, and this year promises to add a further substantial increase.

*Superintendent, Division of Garbage Disposal, Columbus, Ohio.

That the quality of garbage is best indicated by its grease content is shown by the fact that we have been able to hold the tankage production almost uniformly at a hit more than 10 per cent of the green garbage weight. We feel that the quantity of tankage that can be produced from a ton of garbage depends more upon the care and completeness of manufacture than on the richness of the garbage.

Taking this fact as a basis, I do not believe that the quality of the garbage varied much from year to year, until 1916, when wages had advanced considerably, but commodity prices had not, as yet, gone up in proportion. Previous to 1916, grease recoveries were fairly uniform at about 2½ per cent. In 1916, more than 3 per cent of grease was obtained. Since then, grease recoveries have decreased until last year less than 2 per cent was produced. So far this year the quantity of grease secured indicates that the low point was reached in 1919, and with a further decline in the price of food, the grease content or richness of the garbage should slowly increase.

The above is a paper read before the American Society for Municipal Improvements at St. Louis.

Highway Maintenance in Nebraska

The patrol maintenance system of the highways of Nebraska was organized in April, 1920. Each of the five division engineers held meetings with the county boards of his county and took up the matter of highway maintenance in that county, including the amount of funds available. Work was started as promptly as possible and a fairly good mileage has already been covered.

Three methods are being employed—by team, by truck, and by tractor. The team patrol consists of one man who furnishes his own team, a farm wagon, a 6-foot blader, a planer, a scraper or fresno, a plow and small tools. The team patrol receives an average of $175 per month, which is the total cost to the county.

In maintenance by truck patrol, two men are required who receive $120 a month and the gas and oil for the truck is furnished by the county, which is reimbursed by the state. The trucks used are a part of the equipment turned over to the state by the War Department and the counties were charged the freight and expense to the state of obtaining them, averaging nearly $1,000. If purchased at market value they would cost between $3,500 and $5,000 each. The equipment for a truck patrol includes the truck, a scraper, a maintainer, two planers, a plow and small tools.

The tractor patrol method also calls for two men and is used in counties where such equipment was already on hand. The equipment consists of two small tractors, two highway maintainers, a plow, a planer, a buck-scraper and small tools.

The team patrol is given a section averaging six miles in length, the truck patrol section averages seventeen miles, and the tractor patrol averages fourteen miles.

The state had in its possession at the beginning of the season over two hundred army trucks available for use on the state roads and it seemed advisable to use these where there was a large mileage to cover. Last fall teams had been hard to find, the army trucks were not yet available, and the State Highway Department recommended to certain counties that they purchase light farm tractors with which to pull the highway maintainers. These conditions had much to do with the developing of these three types of maintenance.

The Department of Public Works (which has charge of highway work in Nebraska) reports that for all-round careful patrol the team cannot be excelled, as it is much easier to stop and fix ruts, small chuck holes and the like when driving a team than when driving a tractor or a truck. The amount of work accomplished is entirely dependent upon the patrolman, for a conscientious patrolman will work diligently, doing the most careful work possible in the shortest length of time. For this reason among others, the Wisconsin State Highway Department favors the team patrol. In Nebraska, however, where there is a large mileage to cover, it is believed that the truck is perhaps the most economical and the best type of patrol.

The cost of maintenance depends largely upon weather and soil conditions. The condition of the road will regulate the number of times it will have to be gone over. Whether a team or a truck is better will depend to a certain extent on the condition of the road. For instance, on a newly constructed grade with deep fills, the larger part of a team patrolman's time will be spent in using the slip, while on a more level road a truck highway maintainer will take care of 90 per cent of the work.

On the basis of four months of continuous operation, the department has made some comparative cost analyses. These, however, do not take into consideration the conditions of the soils on the various roads, nor the weather, both of which have considerable effect upon the cost. The figures are given as representing the cost of the three kinds of patrol maintenance per day per mile, this including depreciation on state-owned equipment as well as on that owned by the county. The total maintenance cost by tractor patrol in five counties for the three-month period of April, May and June, was $7,532, or $1,506.40 for one county, or $1.38 for one patrol per mile per day. The average for eleven truck patrols during the same months was $1,244.79, which averages 94 cents for one patrol per mile per day. The average for ten team patrols was $649.32 for the three months, or $1.38 per mile per day. The cost per day for the several patrols was $19.31 for tractor patrol, $15.96 for truck patrol and $8.32 for team patrol; the cost per mile per day being obtained by dividing these by the average length of section maintained by each patrol. Comparing the patrols on the basis of equal length of road covered, the cost of team and of tractor patrol was found to be practically the same. It would appear, however, as stated above, that the truck patrol is the most economical and is considered by the department the best type of patrol.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail ,it may help some one.

Excavating Small Earth Trenches

The installation of gas, water, sewer and drain pipes involves the excavation annually of thousands of miles of trenches from 1 to 3 feet wide and from 2 to 10 feet deep. When these are made in hard-pan, rock or indurated strata, it is usually a simple question of picking, barring, drilling and blasting which affords little variety of operations and requires simple, careful work and good judgment.

In clay or dry solid earth or in firm, moist sand the excavation is usually an easy matter either by hand or by the aid of various standard and special appliances. For very soft wet ground, sand, silt, mud and quicksand the work is more difficult and costly and requires special precautions to prevent the earth from caving in or the trench from filling with water.

The most advantageous method of work will, of course, depend on the dimensions of the trench, the length to be dug, the character of the ground, the location in country roads, city or village streets or in open fields, the rapidity with which it must be executed, and the equipment available for the purpose.

In the streets of a large town or city where traffic is heavy or the streets have costly pavements and obstructions may be encountered in doing it, the work is generally done under the direction and according to the requirements of the engineer and little choice remains, the trench being generally excavated by hand and opened in short sections with the least possible obstruction of the streets. In other cases where there is only a small quantity of trench to be excavated or where there are unusual conditions of soil, locality, topography or other features that make it very slow and difficult, it will also probably be necessary to do it by hand in whatever manner suggests itself as most suitable for the circumstances.

MACHINE EXCAVATION

If there is an unusually large amount of trench and the conditions are favorable for excavating by power plant, it may be profitable to install an expensive equipment, but unless it is already available a careful estimate should be made of the cost of purchase or rental, of installation and removal, of maintenance, operation, fuel and other supplies, depreciation, overhead charges and salvage; and the total of these items should not exceed the cost of doing the work by hand, although the latter may appear much more expensive than the direct cost of operating the mechanical equipment. Of course several miles of work, such as irrigation ditches or long lines of drainage or the necessity of completing a long trench with rapidity, may justify mechanical installations that would not otherwise be advisable.

Digging with spade, shovel and pick-ax, although always slow and costly, may often be the most desirable for very shallow, narrow trenches, especially when hand work is necessary to trim and finish the trench before the pipes can be laid. If the depth is more than 6 to 8 feet it becomes difficult to shovel out the material and it is frequently necessary to throw it to a platform half way up, from which it is shoveled to the surface at a greatly increased cost.

HORSE-HAULED EQUIPMENT

The excavation of trenches 12 inches wide and less than 2 feet deep can be much facilitated by the use of a ditching plow drawn by two horses that drag a vertical U-shape cutting blade which merely loosens the earth that is afterwards thrown out by shovels. Another plow making successive 6-inch cuts loosens the soil of trenches up to 8 inches wide and 3 feet deep, afterwards it also is thrown out by shovels. Most of these plows require two or three horses to haul them and two men to operate.

A larger 3-bladed plow drawn by six horses will, under favorable circumstances, excavate 2,000 feet of 12-inch trench of 24 to 30 inches deep in 10 hours. This machine not only cuts and loosens the earth but elevates it to the surface. There are various other types and sizes of horse-drawn machines equipped with plows or cutting knives and with elevating devices that in favorable soil will cut trenches 5 or 6 feet deep and 8 to 14 inches wide. For larger trenches there are on the market a number of power-driven machines that give excellent results under favorable circumstances.

The advantageous use of trench cutting machines is obviously where trenches are of considerable length and in soil that is free from obstructions, cuts easily and will stand for several hours or days with an unsupported vertical face

of the depth of the trench. If the latter quality is doubtful, it is important to lay the pipe as rapidly as possible after the trench has been opened, which, of course, is much more easily done if the machine cuts to the full depth at the first trip. In such cases where the sides of the trench have a tendency to cave in, a shield is sometimes drawn along by the excavating machine and protects the trench while the pipe, usually tile pipe, is laid rapidly in the rear as the machine advances.

SPECIAL SYSTEMS

For wider and deeper trenches, excavating machines are generally replaced by separate or combined systems of excavating and removing the soil and the operations are likely to be prolonged so that in treacherous soil support is more likely to be necessary for the sides of the trench. Where the work is done by hand because many obstructions are likely to be encountered that have to be blasted or excavated around, a system of one or more fixed or movable derricks to hoist buckets or boxes of spoil from the trench may be used. A number of systems of overhead rail trolleys and other conveying systems, including cableways with fixed or movable towers, have been used but their high first cost and cost of installation and moving are not justified unless the work is of considerable magnitude or importance.

Unless there is room to store the spoil alongside the trench until the latter is back-filled, some system of disposal must be provided, and generally is necessary, for disposing of the surplus of the excavated material corresponding to the swelling by handling and to the volume occupied by large pipes installed, especially in city streets where the pavement must be restored to its exact elevation. This can be provided for by trucks or industrial cars on temporary service tracks, or, if the trench is opened up at several places simultaneously and the operations are carefully synchronized, derricks with long booms may suffice to hoist the spoil from the point of excavation and dump it with the same movement at the point of back-fill. This, however, is likely to be much better accomplished by a cableway or overhead trolley system that will enable the soil to be handled several hundred feet and thus increase the working limits.

DRAG-LINE EXCAVATION

For trench excavation in gravel, in hard stratum that does not require blasting, and below groundwater level, as well as for large trenches in very soft materials, the work may sometimes be done to advantage by a drag-line scraper, using one of several forms of drag-line bucket that are so designed as to load, carry and dump by manipulation of the lines with which they are operated by a hoisting engine. These buckets require a considerable longitudinal motion besides their hoisting range and, in the regular drag-line machine, are generally operated from a long derrick boom mounted on a movable platform that advances along the line of the trench. It may, however, be operated from any kind of a boom, from a cableway or from a fixed line carried from a mast to an anchorage. The latter methods do not permit much transverse shifting of the material, while the derrick boom method allows it to be dumped anywhere within radius of the boom.

A simple and efficient drag-line equipment for small work may be improvised from a double-drum hoisting engine, a shear leg and overhead cable and the operating lines. The cable is installed in the line of the trench with both ends securely anchored and with the elevated end over the hoisting engine. The hoisting engine operates a tail line and a hauling line that respectively carry the bucket on the cable trolley to a point between the hoisting engine and the anchorage where it is lowered, and haul it back excavating a load of earth which is then hoisted and pulled along on the cable until it is dumped at any required point in the line of the trench.

If it cannot be dumped in position for back-fill, it may be dumped over as an elevated hopper from which cars or trucks may be loaded and the spoil removed.

A very simple arrangement may be provided by eliminating the cableway and operating a drag-line by an endless cable running around an anchored sheave at the end opposite the hoisting engine. In order to hoist the drag-line bucket from the bottom of the trench, some kind of an artificial incline may be provided which may be easily made with a movable timber platform having a trap near the top, over which the hoisting engine, beyond the incline, hauls the bucket and automatically dumps it through the trap into a hopper or waiting car or truck. Such an apparatus two or three hundred feet long may be made from equipment easily obtained from almost any contractor, or can be purchased in the market.

DREDGING AND DYNAMITING

Very large trenches for irrigation and especially for drainage work, are often made advantageously by regular dredging machines with dipper bucket or with bucket ladders that can be lowered to position and around which a chain of buckets travel continuously hoisting and discharging the material. Some of these dredges are mounted on special narrow pontoons that are floated through the trench they cut while others are moved forward on the surface of the ground.

Small ditches in ground so soft and swampy that it was almost impossible to work by ordinary hand digging, have been blasted with dynamite. Holes a foot or two apart on the center line of the trench are easily punched to a depth of 1 or 2 feet by a stick and are charged with sticks or half-sticks of dynamite that are simultaneously exploded, making, under suitable conditions, a satisfactory drainage ditch with great rapidity and economy. The use of dynamite charged in holes made by a driven rod or auger in hard ground, is also very efficient in loosening and to some extent in removing the earth for ditches and drains on dry land. When the ditch is to be used for pipe laying, it will, of course, be necessary to dress the bottom and sometimes the sides to secure the proper grade and clearance for the pipe.

Recent Legal Decisions

PROCEEDING TO GRADE STATE HIGHWAY—OBTAINING RIGHTS OF WAY CONTRACTING

The Oregon Supreme Court holds, Rockhill v. Benson, 191 Pac. 497, that a proceeding of the state highway commission to grade a highway cannot be enjoined by a taxpayer of the county because of the failure of the commission to obtain some of the rights of way before the grading contract was let. The provision of Laws 1917, p. 447, that the right of way shall be acquired before any contract shall be let is not mandatory on the commission, or prohibitory of the letting of such a contract for such a reason. Where the route adopted by the commission for a state highway would be shorter, the maximum elevation would be considerably less than those afforded by the existing county roads, and there was a question, and room for the exercise of judgment, as to whether it would not ultimately be the cheaper route, the Supreme Court would not interfere with the conclusion of the commission, which it must assume, in the absence of evidence to the contrary, was honestly and conscientiously applied to the facts of the case.

CHEAPNESS AND DESIRABILITY OF OTHER ROUTES NO OBJECTION TO ROAD

In a suit to restrain the construction of a road on a particular route, the Texas Court of Civil Appeals holds, Tippett v. Gates, 223 S. W. 702, that allegations of the comparative cheapness and desirability of other routes do not of themselves constitute any legal ground of complaint. The expense of constructing any particular road is not a proposition the courts can primarily concern themselves about. It is a proposition which belongs entirely to exercise its discretion without further interference. Neither did the fact that more "low, wet and marshy" land will be crossed in building the road afford any legal ground of complaint, notwithstanding the provision of the law that no road shall be laid out or constructed upon such land, except where it is necessary to build directly across it. The Legislature did not intend by this provision to destroy or limit the discretion of the road board and prescribe a rigid rule for road construction across such lands.

STREET EXTENSION MAY BE MADE AT ANGLE WITH EXISTING STREET

The Court of Appeals of the District of Columbia holds, Briggs v. Brownlow, 265 Fed. 985, that the commissioners had discretion, in making a street extension authorized by a special act. to make the extension at an angle with the line of the existing street between the designated terminal streets, and that it was not necessary that the extension continue the existing street in a straight line.

"STREETS" IN STATUTE NOT INTENDED TO INCLUDE "SIDEWALKS"

In determining the meaning of the words "roads" and "streets," as used in statutes, the Alabama Supreme Court holds, City of Mobile v. Harker, 85 So. 425, that not only should the language of the statute be considered, but also the character of the subject. The difference between the public roads of a county and the streets of an incorporated town or city was recognized in McCain v. State, 62 Ala. 138, where it was said that to hold a public road brought within the boundaries of an incorporated town to be still under the jurisdiction of the court of county commissioners would be very unnatural. And in Benton v. City of Girard, 168 Ala. 175, it was pointed out that the city government and the county authorities have separate and distinct functions, and that the duty of keeping in repair the public roads of the county rests with the commissioners' court, but not the streets of any city in the county. It is held that the word "street" as used in Loc. Acts 1907, p. 727, par. 1, divesting the city of Mobile of and investing the county with the control, management and supervision of the streets named therein, was not intended to include sidewalks, which still remain under the control and supervision of the city, which is liable for injuries arising from defects therein.

DEFECTIVE PROCEEDINGS NO FOUNDATION FOR PAVING CONTRACT

Where a property owners' petition for the paving of a street in New Orleans was not signed by 52 per cent or more of the owners of property on the street, as required by the city charter, the Louisiana Supreme Court holds, Grasser Contracting Co. v. Richardson, 85 So. 609, that it was illegal, null and void, and could not serve as a foundation for a contract for the paving, particularly as the owner sued had filed a timely protest against entering into the contract. The illegality of the petition having been brought to the knowledge of the city and presumably to that of the contractor prior to his entering into the contract with the city, and the defect being a radical one, the plea of estoppel was not available to the contractor against the owner under the Louisiana Act of 1914, No. 219.

CLAIMING DAMAGES FOR LOCATION OF ROAD WAIVES IRREGULARITIES

The Nebraska Supreme Court holds, Witherwax v. Holt County, 178 N. W. 925, that where a landowner files a claim for damages caused by the location of a public road over his land, he thereby waives all objections on the ground of irregularities in locating the road. Jurisdiction of the county commissioners to locate a public road having been shown, all subsequent proceedings will be liberally construed, and a substantial compliance with the statute will be held sufficient.

NEWS OF THE SOCIETIES

Nov. 8-12—LEAGUE OF CALIFORNIA MUNICIPALITIES. Annua lConvention, Chico, Calif. W. J. Locke, Pacific Bldg., San Francisco, Calif.

Nov. 10-12—NATIONAL DRAINAGE CONGRESS. Chicago, Atlanta, Ga.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 12—CONFERENCE ON EMPLOYMENT AND EDUCATION, sponsored by the American Assn. of Engineers. Chicago.

Nov. 12—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual meeting. New York City.

Nov. 15-17—CITY MANAGERS, ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Nov. 18-19—AMERICAN ENGINEERING COUNCIL. Organization meeting. Washington, D. C.

Nov. 18-19—FEDERATED AMERICAN ENGINEERING SOCIETIES. Annual meeting. New York; Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting. Topeka, Kansas.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25-27—ASSOCIATED GENERAL CONTRACTORS OF AMERICA. Annual convention. Washington, D. C.; New Orleans.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION

Representatives of fifteen industries identified with highway construction held a meeting at the Automobile Club of America October 22 to complete the organization of an advisory committee of manufacturers to co-operate with the American Road Builders' Association in holding a great exposition of highway equipment and materials in connection with the association's annual convention which will be held at the Coliseum, Chicago, during the week of February 7, next.

The industries represented at the forthcoming exposition will include sand and gravel; crushed stone; Portland cement; asphalt and oil; tar; granite block; paving brick; slag; road building machinery; quarrying machinery; excavating machinery; trucks, tractors and trailers; concrete mixers; engineering instruments, and explosives. It was developed at the meeting that upwards of one billion dollars is annually available for highway and street work and that a genuine necessity exists for capacity production and distribution of highway materials and equipment.

An executive committee to represent the producers and manufacturers was appointed consisting of J. E. Pennybacker of the Asphalt Association; B. H. Wait of the Portland Cement Association; W. T. Chollar of the Lakewood Engineering Company; D. C. Fenner of the International Motor Truck Company and P. P. Sharples of the Barrett Company. A Chicago committee was also appointed with S. F. Beatty of the Austin-Western Road Machinery Company as chairman.

The Virginia Good Roads Association has formed a women's advisory council with a woman for chairman.

AMERICAN ELECTRIC RAILWAY ASSOCIATION

At the Atlantic City convention, October 14, it was resolved that in the regulation of public utilities, "such common sense economies and business principles," be applied, "as will restore credit and enable electric railways to perform their full public service." W. S. Murray, chairman of the superpower survey of the United States, told the convention that a saving of thirty million tons of coal and $300,000,000 a year would be effected by the proposed linking of the power plants of the Atlantic seaboard.

The association voted to widen its membership so as to include investment bankers and consulting engineers whose business brings them in contact with the industry.

H. H. Gadsden of Philadelphia was elected president and E. B. Burritt, New York, secretary-treasurer.

NEW JERSEY STATE HIGHWAY CONVENTION

In order to better co-ordinate activities of the Highway department in the state of New Jersey, it is proposed to hold in Trenton this winter a two-day convention of all the departmental employees. This will include division engineers, assistant engineers, road inspectors, foremen, heads of various units, members of field parties and all others concerned in road construction.

There will be an exhibit of road building materials for the information of employees and others, which will clearly demonstrate what materials will satisfy state standard specifications and what will not pass. It will be held in the laboratory of the Highway Department.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

The American Association of State Highway Officials have been obliged to change their convention date owing to lack of hotel accommodations. The convention will be held in Washington, D. C., on December 13, 14, 15 and 16, instead of December 8, as previously announced.

CITY MANAGERS' ASSOCIATION

At the annual convention of the City Managers' Association, to be held November 15-17, in Cincinnati, Ohio, several papers on paving materials will be presented. Two topics which will receive discussion are: "A Model Paving Program for a City of Twenty Thousand" and "The Relation of Motor Trucks to City Business."

KANSAS CITY ENGINEERS' CLUB

The Engineers' Club has been strenuously engaged in securing the adoption of amendments to the state constitution providing means for raising the bonded indebtedness for Kansas City in order that sufficient bonds can be voted for a new water plant and filtration system.

At a meeting of the club on October 22 resolutions were adopted endorsing amendments to the state constitution providing for a sixty million dollar bond issue for good roads in Missouri, and for a Kansas constittuional amendment providing for state aid for the construction of roads in Kansas.

POLITICAL CANDIDATES STATE THEIR VIEWS

Mr. Nathan L. Miller of Syracuse and Governor Alfred E. Smith, as candidates for the gubernatorial election have replied to the questionnaire submitted by this chapter. The answers submitted by Governor Smith explain the questions asked.

"1. I am in favor of the establishment of a budget system for all state expenditures.

"2. I am in favor of the establishment of a bureau of public works under efficient engineering direction.

"3. I favor placing the planning, construction and maintenance of a comprehensive and modern highway system under such a bureau.

"4. I favor the appointment of competent engineers as a part of the membership of public service commissions and other bodies supervising work largely of an engineering nature.

"5 I am in favor of seeking in an aggressive manner a solution of the problems involved in making New York City the foremost part of the world."

Mr. Miller replied: "I am glad to be able to answer all of your questions categorically in the affirmative."

ASSOCIATED GENERAL CONTRACTORS

The Associated General Contractors of America headquarters has been moved from Chicago to Washington, D. C.

PERSONALS

Cooper, S. W., has been appointed assistant engineer, 4th Division, Alabama Highway Department, headquarters at Selma, Ala.

Hands, S. M., has resigned as city engineer of Iowa City, Ia., and has been made president of a quarry company.

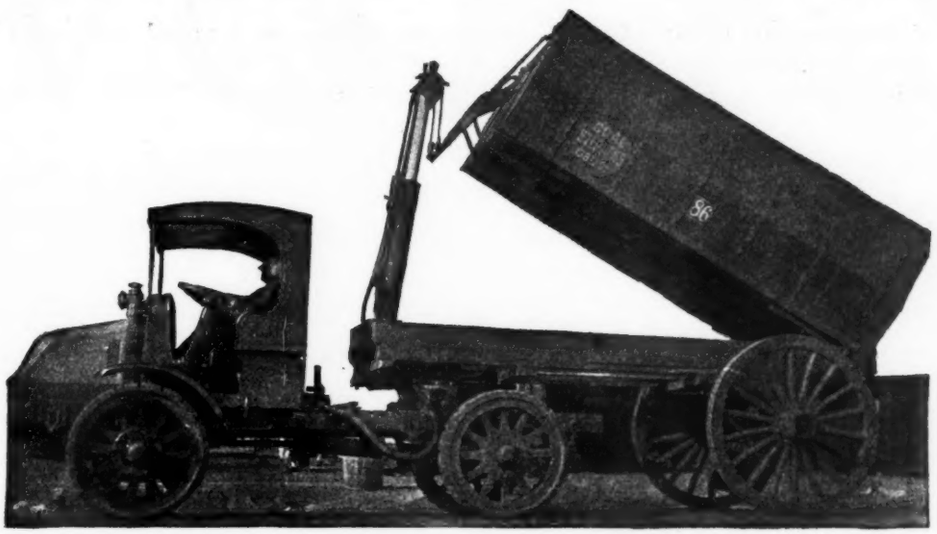
Bruce, J. A., has resigned as city engineer of Omaha, Neb., and has opened an engineering office.

Siteman & Cooper have opened engineering offices in the Federal Reserve Bank Building, St. Louis.

Powell, O. N., has been appointed engineer of Nueces county, Texas.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



WALTER TRACTOR WITH AUTOMATIC DUMP BODY

THE WALTER TRACTOR—(Illus.)

The Walter four-wheel-drive tractor made by the Milwaukee Locomotive Manufacturing Company is designed to combine American practice with foreign military development for powerful and economical road hauling. Provision is made for applying power to each of the four wheels, a feature which enables the tractors to haul loads in mud, sand or snow, to surmount obstacles and climb steep grades impossible to other tractors.

The tractors have four forward speeds and one reverse. The stearing gear operates on all four wheels so as to make the rear wheels track and enables the tractor to make exceedingly short turns, running in a minimum circle of 26 feet diameter.

The powerful foot and hand brakes are of the contracting band type. The tractor is equipped with a powerful rear winch having 100 feet of ⅝-inch steel cable for pulling trailers in soft ground or on steep grade or for extricating the tractor itself from muddy or sandy places. The tractor has a draw bar pull of up to 5,000 pounds. The tractor is designed to be used as a truck or to haul trailers, and is equipped with a platform, a stake body, a special body built to specifications, or a dump body discharging either to the side or the rear.

When hauling four-wheel trailers, the tractor will easily pull 8-ton loads on dirt roads and 15-ton loads on pavements.

The motor is of the long-stroke, four-cylinder, four-cycle, water-cooled type, delivering 40 h. p. at low speed. The maximum speed of the engine is controlled by the governor with a motor speed of 1,000 revolutions per minute. The speed of the tractor varies from 2¼ to 12½ miles per hour.

CLARK METER COUPLING YOKE

The Clark meter coupling yoke, manufactured by the H. W. Clark Company, can be set on any supply pipe without the use of unions, and is provided with a sliding adjustment which takes care of all strain from expansion and contraction in the pipe line.

To install the yoke, the pipe is cut in two and both ends of the pipe are bent in opposite directions, threaded and ells screwed on. Risers are attached to the ells and the yoke is slipped on over slide block and the ells screwed on to the risers.

The yoke being kept transverse in the service line gives great flexibility to the latter.

In basement installations the entire vertical line is held rigid, the yoke and upper section being supported vertically by the lower section of the riser pipe with provisions through a sliding pin in slot for the adjusting movement of the yoke.

METER BOX COUPLING YOKE

BASEMENT COUPLING YOKE

American Steam Conveyor Corporation, Chicago, has changed its name to Conveyors Corporation of America.

PERSONALS

Neville, C. C., of the Construction Division of the United States army, was killed in the Wall street explosion, New York, September 16.

Leighton, George, one of the engineers of the Pennsylvania tunnels, New York, died at Glenburn, Pa., September 13.

Demeritt, H. L., United States Engineer, rivers and harbors service, died at Oakland, Cal., September 7.

New Catalogs of Interest to City and County Engineers, Superintendents of Water Works, Superintendents of Streets, Contractors and all Engaged in Public Works

If you want any of these Catalogs, write the number on a postal, sign your name and address plainly, and mail it to PUBLIC WORKS, 243 W. 39th St., New York. The Catalogs will be sent to you promptly without charge or obligation.

POWER TRANSMISSION MACHINERY

1. The A. & F. Brown Company, engineers, founders and machinists, Elizabethport, N. J. 5 x 8 inches, stiff covers, 129 pages and index. Lists gears, turned steel shafting, quill shafts, collars, split collars, compression couplings, band couplings, pin couplings, angle couplings, double angle couplings, clutch couplings, friction clutches, friction clutch pulleys, bronze bushings, pulleys of various kinds, pulley stands, coiling devices, shaft bearings, wall brackets, belt tighteners, rope sheaves, tension carriages, speed reducing devices, foot valves, mixers and grinders.

FERGUSON SEWAGE DISPOSAL SYSTEM

2. Ferguson Segment Block Company, St. Louis, Mo. 6 x 9 inches, illustrated, 9 pages. Description of design and operation of system with four sizes of installations intended to serve from one to thirty persons.

PRUDENTIAL STEEL BUILDINGS

3. Blaw-Knox Company, Pittsburgh. 7½ x 10½ inches, embossed covers, 32 pages, illustrated. List and description of standard sectional steel buildings for light manufacturing, housing, storage, hospitals, garages, shops and other purposes. Essential features, advantages, and dimensions and views of buildings used by U. S. Government and other important clients, drawings of plans, elevations and details and specifications governing designs and fabrication.

STEEL PIPE COUPLINGS

4. S. R. Dresser Manufacturing Company, Bradford, Pa. 7½ x 10 inches, 109 pages and index, illustrated, stiff covers. Policy of company, descriptions and illustrations of plant, lists, sizes, and engravings of bolts, caps, casing heads, couplings, clamps, crosses, ells, pipe fittings, gaskets, nipples, oil well supplies, saddles, screens and other articles.

TROY TRAILERS

5. The Troy Wagon Works Company, Troy, Ohio. 9 x 12 inches, 29 pages, illustrated. Descriptions, specifications and illustrations of four models of trailers of 1 to 5 tons capacity. Half-tones and descriptions of principal details of construction. Drop frame trailers, dump bodies and general and special equipment.

WALTER 4-WHEEL DRIVE TRACTOR

6. Publication No. 106. M" Locomotive Manufacturing Company, Milwaukee, Wis. 11 x 8½ inches, 20 pages, illustrated, stiff covers. Important features, designs and description of details, specifications.

MILWAUKEE GASOLINE LOCOMOTIVE

6. Milwaukee Locomotive Manufacturing Company, Milwaukee, Wis. Publication No. 118. 10 x 6¾ inches, 36 pages, illustrated, stiff covers. General description of designs, principles and important features of seven types of locomotives for standard and narrow gauge tracks. General specifications for different types.

THE LITTLE WONDER TILE DITCHER

7. Edward Jeschke, Bellevue, O. Folder describing and illustrating horse-drawn machine guaranteed to cut a ditch 10 to 14 inches wide and 30 inches deep. Testimonials from purchasers and records of efficiency.

LAND DREDGES

8. Bay City Dredge Works, Bay City, Mich., 10 x 6½ inches, 46 pages, illustrated. Description of important features of Bay City Land Dredges of the walking type, track type and floating type. Descriptions and illustrations of Bay City Gravel Loader and Bay City Clay Excavator. Illustrations of equipment installed and in operation for various purchasers.

ECONOMY EXCAVATOR

9. Economy Excavator Company, Iowa Falls, Iowa. 7 x 10¼ inches, illustrated, 24 pages in adjustable file cover. Descriptions, claims of efficiency and economy and advantages for operating in open work, for ditch cleaning and repairing, for road and railroad work, and for bank shoveling.

THE BLAW BULL DOG BUCKET

10. Blaw-Knox Company, Pittsburgh. Folder describing construction and showing details and dimensions of heavy excavating clamshell bucket.

REINFORCED CONCRETE PIPE

11. Independent Concrete Pipe Company, Indianapolis, Ind. Bulletin No. 9. 6 x 9 inches, 60 pages, illustrated. Description of pipes of standard diameter 24 to 90 inches for sewers, conduits, drainage, culverts and irrigation work, the pipes being cast at site according to design and with equipment and superintendent furnished by the pipe company. Half-tones of manufacture and installation of pipe and of pipe designs and of detail drawings.

SHUVELODER

12. The Superior Loader Company, Duluth, Minn. 6 x 9 inches, 50 pages, illustrated. Description of 4,300-pound machine 4 feet high, 4 feet wide and 6 feet long with capacity for loading 45 tons per hour handling rock, earth or ore to a height of 50 inches, with a bucket operated by power to scoop, lift and deliver as required. Driven by compressed air and operated by one man.

EVERYTHING FOR THE ROAD MAKER

13. The Good Roads Machinery Company, Incorporated, Kenneth Square, Penn. 10 x 7 inches, 64 pages, illustrated. Lists, describes and gives specifications for Little Winner, Big Winner, Giant Winner and National Hercules road graders, Champion road machines, scarifiers, road drags, wheel and drag scrapers, ploughs, rock crushers and portable bins, elevators and revolving screens, portable engine and boiler, winding drum and dump car, rock drill, gravel crushing and screening outfit, road rollers, road oiling machines and distributors, concrete mixers, pumps, car unloaders, street sweepers and sprinklers, culvert pipe and other supplies.

KOEHRING CONSTRUCTION MIXERS

14. Koehring Machine Company, Milwaukee, Wis. Catalog No. 22. 7¾ x 10¾ inches, 95 pages, illustrated, stiff covers. Important features of principle, construction and mechanical details of concrete mixer with notes of improvements and of advantages of different parts. Illustrations, specifications, and diagrams of different types and size machines; instruction for operating, bar cutting and bending machines, convenient tables of quantities of concrete in slabs and footings, material required per yard of concrete, weight, areas and circumferences of reinforcement bars.

GOOD ROADS FROM ROCKY FIELDS

15. United Iron Works, Incorporated, Kansas City, Mo. 10 x 6¾ inches, 22 pages, illustrated. Lists and descriptions of stone crushers and illustrations of stone crushing, cleaning, lowering and elevating the plant installed for road building. See catalog for full list of good road machinery.

BEST TRACKLAYER TRACTOR

16. C. L. Best Gas Traction Company, San Leandro, Cal. 7½ x 10½ inches, 32 pages illustrated, heavy paper, embossed covers. Description of history and development of an early gasoline tractor. Illustrations and descriptions of motor, oscillating truck, special features and mechanical details of the "60" tractor of 60 h. p. for hauling and general heavy duty work. Specifications. Illustrations of Cruiser and Swamp Special types.